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(71)Applicant : SEIKO EPSON CORP (72)Inventor : YAJIMA FUMITAKA

(54) LIQUID CRYSTAL PROJECTOR

SPECIFICATION

1. Title of the Invention

LIQUID CRYSTAL PROJECTOR

2. Claims

(1) A liquid crystal projector comprising: a case; a base plate disposed within the case; a lamp housing unit having a projection light source; a light guide unit having light separating means incorporated therein; and an optical head unit formed by combining liquid crystal light valves for forming images, a light-combining prism, and a projection lens, wherein these elements are arranged on the base plate so that a principal light path has an L-shape in plan view, and the projection lens and the lamp housing unit face a window on the front surface of the case and an opening on the back surface of the case, respectively.

(2) A liquid crystal projector according to Claim (1), further comprising: a power supply unit disposed between one side surface of the case and the lamp housing unit; a driving control circuit unit arranged between the other side surface of the case and the light guide unit; a cooling fan for cooling the optical head unit disposed under the optical head unit; and a cooling fan for cooling the lamp housing unit arranged in a space surrounded by the light guide unit, the lamp housing unit, and the front surface and one side surface of the case, and generated by formation of the L-shaped principal light path.

(3) A liquid crystal projector according to Claim (1), further comprising: a power supply unit; and a driving control circuit unit,

wherein the lamp housing unit, the light guide unit, the optical head unit, the power supply unit, and the driving control circuit unit are individually and detachably attached to the base plate.

(4) A liquid crystal projector according to Claim (1), further comprising a driving control circuit unit formed of an analog circuit unit and a digital circuit unit, wherein the analog circuit unit and the digital circuit unit are separated from each other, and one of them is arranged on the top surface of the light guide unit.

(5) A liquid crystal projector according to Claim (1), further comprising an outer housing fixed to the base plate, wherein the lamp housing unit is placed at a predetermined position and supported inside the outer housing, and the lamp housing unit can be put in and taken out through the opening on the back surface of the case.

3. Detailed Description of the Invention

[Technical Field of the Invention]

The present invention relates to a liquid crystal projector, for large-screen displaying by magnifying and displaying images with a lens, using at least three liquid crystal light valves for forming images.

[Description of the Related Art]

A so-called liquid projector has been known, which uses three liquid crystal light valves respectively controlling red, green, and blue light so as to combine these three light rays so that the composite light is magnified and projected via a lens (Japanese Unexamined Patent Application Publication No. 60-179723 and Japanese Unexamined Patent Application Publication No. 61-150487, for example).

[Problems to be Solved by the Invention]

The aforementioned conventional liquid crystal projector is planned to reduce the size and weight by combining the red, green, and blue light with a plurality of dichroic mirrors; however, although it is much smaller in size than a video projector using a CRT, it has not been sufficiently miniaturized yet due to the occupied space of the dichroic mirrors.

In order to obtain a miniaturized liquid crystal projector, the same applicant previously proposed use of one dichroic mirror prism instead of plural dichroic mirrors for combining mixed colors, while a light path length between a projection light source and each liquid crystal light valve is configured so as to be the largest for a high-intensity color ray and the smallest for a low-intensity color ray, and further only one of three light valves is controlled to reverse a display laterally (Japanese Patent Application No.).

It is an object of the present invention to provide a further miniaturized liquid crystal projector which is also improved in operation, durability, and ease of maintenance by improving arrangements of peripheral associated members on the basis of the aforementioned configuration.

[Means for Solving the Problems]

In order to achieve the aforementioned object, a liquid crystal projector comprises a rectangular case, a base plate disposed within the case, a lamp housing unit having a projection light source, a light guide unit having light separating means incorporated therein, and an

optical head unit formed by combining liquid crystal light valves for forming images, a light-combining prism, and a projection lens, wherein these elements are arranged on the base plate so that a principal light path has an L-shape in plan view, and the projection lens and the lamp housing unit face a window on the front surface of the case and an opening on the back surface of the case, respectively.

A liquid crystal projector further comprises a power supply unit disposed between one side surface of the case and the lamp housing unit, a driving control circuit unit arranged between the other side surface of the case and the light guide unit, a cooling fan for cooling the optical head unit disposed under the optical head unit, and a cooling fan for cooling the lamp housing unit arranged in a space surrounded by the light guide unit, the lamp housing unit, and the front surface and one side surface of the case, and generated by formation of the L-shaped principal light path.

The lamp housing unit, the light guide unit, the optical head unit, the power supply unit, and the driving control circuit unit are individually and detachably attached to the base plate.

The driving control circuit unit is divided into an analog circuit unit and a digital circuit unit, and one of them is arranged on the top surface of the light guide unit.

The lamp housing unit is placed at a predetermined position and supported inside an outer housing fixed to the base plate, and the lamp housing unit can be put in and taken out through the opening on the back surface of the case.

[Operation]

The light emitted from the projection light source (white light) and led to the light guide unit is divided into three primary colors, red, green, and blue, in the light guide unit, and each colored ray is modulated by a video signal which is input in the liquid crystal light valve every color when passing through respective liquid crystal light valves.

Then, the modulated colored rays are combined into composite light by the prism while being magnified and projected on a screen via the lens.

By rotating to slide the projection lens facing the window on the case front surface, the focus of the lens is adjusted.

By the fan located under the optical head unit, the liquid crystal light valves and the prism are cooled. By the fan arranged close to the lamp housing unit, the lamp housing unit is also cooled. The cooling air is also fed to the power supply unit located in the side of the lamp housing unit so as to prevent the power supply unit from being excessively heated.

Since the control circuit unit for driving the liquid crystal light valves is arranged at a position opposite to the power supply unit and the lamp housing unit, etc., the control circuit unit cannot be thermally affected. Also, the driving control circuit unit is divided into the analog circuit unit and digital circuit unit, so that both the units do not interact with each other so as to reduce noises.

The replacement of the projection light source lamp is performed by

taking out it together with the lamp housing unit through the opening on the case back surface. After the lamp replacement, when the lamp housing unit is inserted into the opening, the lamp housing unit is precisely positioned within the outer housing.

The maintenance of component units including the lamp housing unit is performed by opening the case and removing each unit from the base plate.

[Embodiments]

An embodiment of a liquid crystal projector according to the present invention will be described below with reference to the drawings.

Fig. 1 is an exterior perspective view of a liquid crystal projector according to the present invention, in which within a rectangular case 1, the entire components are accommodated and unitized in each individual function.

The rectangular case 1, as shown in Fig. 2, is separably formed of a bottom board 1A, a front board 1B, a back-face board 1C, and top board 1D being integral with both-side boards.

In the front of the bottom surface of the bottom board 1A, a pair of legs 2 with screws for vertically adjusting the projecting direction are provided on both sides. Ventilation slits 3 are also formed at a position under an optical head unit, which will be mentioned later.

At a position laterally deviated slightly from the center of the front board 1B, a lens window 4 is opened, which is covered with a cover board 5 which is slidable on either side. The cover board 5 is slid away during projection. In a central portion of the front board 1B,

various knobs 6 are attached for adjusting images and sounds, etc. An opening 7 for taking out and in a lamp-housing unit is opened at a position deviated slightly from the center of the back-face board 1C toward a direction opposite to the lens window 3 of the front board 1B. The opening 7 is covered with a panel formed integrally with the lamp-housing unit which will be described later.

The back-face board 1C, as shown in Fig. 3, is provided with an outlet 8 for connecting power supply, a knob 9 for switching the power supply, and terminals 10 for inputting various signals.

As shown in Fig. 2, corners between the top board 1D and the bottom board 1A are provided with pins 11 for positioning and receiving tubes 12 formed vertically corresponding to each other. To the front and back of the top board 1D and the bottom board 1A assembled to each other by fitting the pins 11 for positioning to the receiving tubes 12, the front board 1B and the back-face board 1C are fitted with screws so as to assemble the case 1. Ventilation slits 13 are formed at a position deviated from the center of the top board 1D toward the power supply over a wide area. Under the ventilation slits 13, a speaker is installed, which is, however, omitted in the drawing.

On the bottom board 1A, a base plate 14 is detachably attached with screws, etc.

On the base plate 14, a lamp housing unit 15, a light guide unit 16, and an optical head unit 17 are arranged, so that a principal light path has an L-shape in plan view (see Fig. 9), a projection lens 18 of the optical head unit 17 faces the window 4 at the front of the case, and

the lamp housing unit 15 faces the opening 7 on the back face of the case.

A power supply unit 19 and a driving control circuit unit 20 are also arranged outside the lamp housing unit 15 and the light guide unit 16, respectively. The lamp housing unit 15, the light guide unit 16, the optical head unit 17, the power supply unit 19, and the driving control circuit unit 20 are arranged individually detachably in the base plate 14.

The driving control circuit unit 20 includes an analog circuit unit and a digital circuit unit, both of which are respectively unitized. One of these units 201 is arranged on the top surface of the light guide unit 14.

Below the optical head unit 17, the base plate 14 is provided with a flat propeller fan 21 attached thereto, which blows the outside air taken from the ventilation slits 3 of the case bottom board 1A toward the optical head unit 17, so as to especially cool a polarizing plate of the light valve. A sirocco fan 22 is attached to the base plate 14 in a space S (see Fig. 9) surrounded by the light guide unit 16, the lamp housing unit 15, one case side-face 1E, and the case front surface 1B, which is consequently formed by arranging each of these units so that the principal light path has an L-shape. The sirocco fan 22 forcibly exhausts the heat generated from the lamp housing unit 15 via the ventilation slits 13 of the top board 1D by carrying the heat on the stream of the outside air taken from a vicinity of the unit 15. The heat of the power supply unit 19 and the air warmed by cooling the

optical head unit 17 are also exhausted in a similar manner.

Fig. 4 is an exterior perspective view of the lamp housing unit 15 and an outer housing 23 for accommodating and supporting the unit 15. The outer housing 23 is fixed to the base plate 14, and an opening 24 on the back surface thereof faces the opening 7 of the case back-face board 1D.

The lamp housing unit 15, as shown in Fig. 4 and the assembly view of Fig. 5, supports a projection light source lamp 26, which can be a halogen lamp, within box frames 25A and 25B. Numeral 27 denotes a reflector, in which a reflector with a cold mirror for an anti-heat measure and a multi-mirror reflector for improving brightness are used. Numeral 28 denotes a lamp socket; numeral 29 denotes an ejector for taking off the lamp; numeral 30 denotes a light-guide tube disposed on the front side in the light path direction of the box frame 25B; numeral 31 denotes an air-guide tube disposed on a surface of the box frame 25B in the side of the sirocco fan 22; and numeral 32 denotes a panel portion integrally formed on the surface of the box frames 25A and 25B in the case back-face side. The panel portion 32 is lager in size than the opening 7 of the case back-face, and after the lamp housing unit 15 is accommodated within the outer housing 23 via the opening 7, the opening 7 is covered with the panel portion 32 of the lamp housing unit 15. Numeral 33 denotes knobs integrally formed on the panel portion 32, and the lamp housing unit 15 is put in or taken out by picking the knobs 33. Numeral 34 denotes a locking member of the lamp housing unit 15 relative to the case 1, and a knob 34A for operating the locking member

is located in the center between the knobs 33.

The lamp hosing unit 15 is supported by making multiple points of contact with the outer housing 23 so as to reduce frictional resistance during putting in and out, and to improve positioning accuracies as well. The positioning of the lamp housing unit 15 relative to the outer housing 23, i.e., the position of the projection light source lamp 26 is determined by an outer surface of the box frame 25B of the lamp housing unit 15 and three springs 35 (see Figs. 5 and 7) acting in every directions, i.e., back and forth, vertical, and lateral directions, relative to the light path direction relatively arranged on an internal surface of the outer housing 23.

The outer housing 23 is also provided with a light-guide tube 36 linked to the light-guide tube 30 of the lamp housing unit 15, as shown in Figs. 4 and 6. Internal surfaces of both the light-guide tubes 30 and 36 are mirror-finished so as to improve brightness and cooling efficiencies.

Furthermore, when the lamp housing unit 15 is accommodated within the outer housing 23, the unit 15 has just a double structure, so that the flow rate of the outside air taken from the slits 37 disposed on the panel portion 32 and flowing through the clearance between the lamp housing unit 15 and the outer housing 23 is increased and a part of the outside air taken from the slits 37 accurately flows around the light source lamp 26, thereby sufficiently cooling the lamp housing unit 15. Therefore, the life of the lamp 26 is increased and the case 1 is not overheated. Numeral 38 denotes a thermal fuse for breaking the power

supply disposed for the safety in case the case 1 is overheated. A thermal-ray cut filter 39 is laid on an end face of the light-guide tube 36 of the outer housing 23 in the light source lamp side so as to be fixed with a presser plate 40. On the end-face of the light-guide tube 36 opposite to the light source lamp, a mask 41 is formed. Numeral 42 denotes a connector for connecting a lamp socket 28 of the lamp housing unit 15 so as to apply current.

Fig. 8 is an exterior perspective view of the light guide unit 16 and the optical head unit 17.

The light guide unit 16 is formed by assembling a dichroic mirror system into a light-guide tube formed of a pair of upper and lower frame plates 44 and 45 having U-shapes in plan view and internal and external side plates 46 and 47, so as to be tubular shaped. The internal surface of the light-guide tube is mirror-finished so as to improve reflectance and restrain reduction in brightness.

In the dichroic mirror system, as shown in Fig. 9, a blue reflection dichroic mirror 48, a green-light-reflection dichroic mirror 49, and a normal reflection mirror 50 are arranged from the side of the light source 26 in that order, and furthermore, reflection mirrors 51 and 52 are arranged corresponding to the blue reflection dichroic mirror 48 and the reflection mirror 50 located in the most separated position, respectively, so that blue light reflected and diverted by the blue reflection dichroic mirror 48 and red light reflected and diverted by the reflection mirror 50 are turned inside, respectively. When color separation order is set as described above, the light path length of

blue light is shorter while light path length of red light is longer, so that brightness, color reproducibility, and color balance are improved.

In a central space of the light guide unit 16 having a U-shape in plan view, the optical head unit 17 is arranged, so that a light combining prism 53 and liquid crystal light valves 54, 55, and 56 arranged respectively on three surfaces of the prism 53 coincide with optical paths of blue light, green light, and red light separated by the dichroic mirror system of the light guide unit 16, respectively.

The liquid crystal light valves 54, 55, and 56 modulate a blue light signal, green light signal, and red light signal in active matrix liquid crystal panels incorporating drivers therein, respectively.

The prism 53 is a dichroic prism formed by bonding four rectangular prisms with each other on respective two surfaces of each prism interposing a right angle therebetween so that wavelength selective reflection layers (a blue-light reflection surface and a red-light reflection surface) intersect perpendicularly each other.

When separating and combining light are described with reference to Fig. 9, a blue-light-reflection dichroic mirror 48 reflects blue light while allowing other colored rays to pass therethrough. The reflected blue light is diverted by the reflection mirror 51 so as to enter a blue-light-modulation liquid crystal light valve 54.

The colored rays which have passed through the blue-light-reflection dichroic mirror 48 enter the green-light-reflection dichroic mirror 49 so as to reflect only green light while allowing red light which is another light. The reflected green light proceeds straight so

as to enter a green-light-modulation liquid crystal light valve 55.

The red light which has passed through the green-light-reflection dichroic mirror 49 is diverted by the reflection mirror 50 and further diverted by the next reflection mirror 52 so as to enter the red-light-modulation liquid crystal light valve 56.

In the colored rays modulated by the liquid crystal light valves, the blue light is reflected by a blue-light reflection surface 57 of the prism 53; the red light is reflected by a red-light reflection surface 58; and the green light proceeds straight through the prism 53, so the rays are combined to be one color image so as to be magnified and projected by the lens 18 on a screen.

According to the structure described above, while respective pieces of image information obtained from the blue-light-modulation liquid crystal light valve 54 and the red-light-modulation liquid crystal light valve 56 are inverted by the reflection surfaces 57 and 58 of the prism 53, respectively, the image information from the green-light-modulation liquid crystal light valve 55 is not laterally inverted, so that a driver circuit of only the green-light-modulation liquid crystal light valve 55 is configured so as to laterally invert display, thereby matching the composite image display.

Fig. 10 is an assembly view showing a specific structure. In the center of a box frame opened laterally and formed by combining top/bottom and front/rear boards 59, 60, 61, and 62, the dichroic prism 53 is positioned and supported by three springs 63 (only one shown in the drawing) acting in back and forth, lateral, and vertical directions,

respectively.

The lens 18 is mounted and coincided with a front surface opening 61A of the box frame front board 61, and the blue-light-modulation liquid crystal light valve 54, the red-light-modulation liquid crystal light valve 56, and the green-light-modulation liquid crystal light valve 55 are mounted in the right and left openings of the box frame and the rear of the rear board 62 via springs 64, respectively, so that optical axes in top/bottom, right/left, and front/rear directions are adjustable.

Each of liquid crystal light valves 54, 55, and 56 is clamped between a pair of front and rear supporting plates 65 and 66 together with an insulation sheet 67 and a polarizing plate (not shown), etc., leaving slight clearances between the liquid crystal light valve and the front/rear plates. Each of the supporting plates 65 is provided with a skirt-type guide plate 65A opened outwardly on the lower side of the plate 65, which is further outside. Thereby, as shown in the enlarged longitudinal sectional view of Fig. 11, the outside air taken inside the case 1 by the fan 21 located under the optical head unit 17 can be guided to each of liquid crystal light valves 54, 55, and 56 without being discharged outside, resulting in improving cooling efficiency. That is, the plate member supporting the liquid crystal light valve has a cooling air guiding function itself.

[Advantages]

As a liquid crystal projector according to the present invention has the structure described above, for large-screen displaying by

magnifying and projecting color composite images with a lens using at least three liquid crystal light valves for forming colored images, a lamp housing unit, a light guide unit, an optical head unit including a light valve, a light combining prism, and a projection lens, a cooling fan for the lamp housing, and a cooling fan for the optical head unit, especially for a polarizing plate, etc., can be compactly assembled within a rectangular case, and image quality is improved with high cooling efficiency. The projector is also portable.

Since the aforementioned each functional unit, a power supply unit, and a driving control circuit unit are individually and detachably mounted on a base plate within the case, assembling operation during manufacturing is simple and efficient, resulting in improved productivity. Also, maintenance and replacement in every unit can be easily performed.

Since the driving control circuit unit is arranged separating it from heating elements such as the power supply unit and the lamp housing unit, the driving control circuit unit cannot be thermally affected.

Also, the driving control circuit unit is arranged dividing it into an analog circuit unit and digital circuit unit, so that both the units do not interact with each other so as to eliminate noises.

The projection light source lamp is often replaced; in this case, the lamp can be replaced by pulling it out together with the lamp housing unit from the outer housing fixed to the case without opening the case, eliminating troublesomeness. When the lamp housing unit is inserted into the outer housing, it is placed at a predetermined

position, eliminating later adjustment of the optical axial so as to improve operationality.

4. Brief Description of the Drawings

Fig. 1 is an exterior perspective view of a liquid crystal projector according to the present invention; Fig. 2 is a perspective view of a case showing a disassembled state; Fig. 3 is an exterior perspective view of the projector as viewed from the back side; Fig. 4 is a perspective view of a lamp housing unit showing a pulled out state from an outer housing; Fig. 5 is an assembly view of the lamp housing unit; Fig. 6 is an assembly view of the outer housing; Fig. 7 is a drawing of the outer housing as viewed from the side for pulling in and out of the lamp housing unit; Fig. 8 is an exterior perspective view of a light guide unit and an optical head unit; Fig. 9 is a plan view for illustrating schematic arrangement of each unit and optical paths; Fig. 10 is an assembly view of the optical head unit; and Fig. 11 is an enlarged longitudinal sectional front view of an essential part of the optical head unit.

1: rectangular case, 1A: bottom board, 1B: front board, 1C: back-face board, 1D: top board, 1E, 1F: side board, 4: front surface window, 7: back surface opening, 14: base plate, 15: lamp housing unit, 16: light guide unit, 17: optical head unit, 18: projection lens, 19: power supply unit, 20: driving control circuit unit, 21: cooling fan for optical head unit, 22: cooling fan for lamp housing unit, 23: outer housing of lamp housing unit, 26: projection light source, 53: light combining prism, 54, 55, 56: liquid crystal light

valve, and S: space.

VOLUNTARY AMENDMENTS

(1) Claims will be amended as stated in the accompanying sheets.

(2) Specification from the 2nd lowest line, p.4 to the 9th line, p.6, "a liquid crystal projector comprises------ on the back surface of the case.", will be amended below.

Description

firstly, a liquid crystal projector comprises a case, a projection light source having a cooling fan, light separating means for dividing light emitted from the light source into a plurality of colored rays, a plurality of image-forming liquid crystal light valves for forming images by respectively modulating the divided colored rays, light combining means for combining the colored rays modulated by the liquid crystal light valves, and a projection lens for projecting the composite images combined by the light combining means, wherein the projection light source, the light separating means, the plurality of image-forming liquid crystal light valves, the light combining means, and the projection lens are arranged within the case so that a principal light path of one colored ray from the light source to the projection lens is configured so as to have an L-shape in plan view, and wherein the cooling fan of the projection light source is arranged in a space surrounded by the light separating means, the light source, and the front surface and one side surface of the case, and generated by formation of the L-shaped principal light path.

Secondly, a liquid crystal projector comprises a case, a projection

light source, light separating means for dividing light emitted from the light source into a plurality of colored rays, a plurality of image-forming liquid crystal light valves for forming images by respectively modulating the divided colored rays, light combining means for combining the colored rays modulated by the liquid crystal light valves, a projection lens for projecting the composite images combined by the light combining means, a power supply unit, a cooling fan, and a driving control circuit, wherein the projection light source, the light separating means, the plurality of image-forming liquid crystal light valves, the light combining means, and the projection lens are arranged within the case, and in the vicinity of the light source, the power supply unit and the cooling fan for cooling the light source and the power supply unit are arranged, and wherein the driving control circuit is arranged at a position within the case and separated from the power supply unit.

Thirdly, the liquid crystal projector further comprises a second cooling fan disposed under the liquid crystal light valves.

(3) Specification from the 11th line, p.6 to the 4th, p.8, "The light emitted from----- from the base plate.", will be amended below.

Description

Emitted colored light led to the light separating means is divided into each of colored rays so as to be modulated during passing through the respective liquid crystal light valves. The modulated colored rays are combined into composite light by the light combining means while being led to the projection lens and projected on a screen.

The light source is cooled by a fan disposed closed to the light source. The cooling air is also fed to the power supply unit so as to prevent the power supply unit from being heated. Since the control circuit unit for driving the liquid crystal light valves is arranged at a position opposite to the power supply unit and the light source, the control circuit unit cannot be thermally affected.

Moreover, by a fan disposed under the liquid crystal light valves, the polarizing plate of the light valve is cooled.

(4) Specification from the 3rd lowest line, p.9 to the 20th, p.9, "at a position----- over a wide area.", is amended to "in the upper part of the sirocco fan 22.

(5) The 5th line, p.13 of the specification, "the knobs 33", is added next by "and a knob 34A for operating the locking member".

(6) Specification from the 4th line, p.20 to the 13th, p.21, "for large-screen displaying---- to improve operationality.", will be amended below.

Description

a projection light source, light separating means for dividing light emitted from the light source into plural colored rays, plural image-forming liquid crystal light valves for forming images by respectively modulating the divided colored rays, light combining means for combining the colored rays modulated by the liquid crystal light valves, and a projection lens for projecting the composite images combined by the light combining means are arranged within a case so that a principal light path of one colored ray from the light source to the projection lens is configured so as to have an L-shape in plan view, and a cooling

fan of the projection light source is arranged in a space surrounded by the light separating means, the light source, and the front surface and one side surface of the case, and generated by formation of the L-shaped principal light path, thereby the cooling fan can be compactly put within the case, and image quality is improved with high cooling efficiency.

Also, since in the vicinity of the light source, the power supply unit and the cooling fan for the light source and the power supply unit are arranged, the light source is cooled together with the power supply unit, and as the driving control circuit unit is arranged and separated from heating elements such as the power supply unit and the lamp housing unit, the driving control circuit unit cannot be thermally affected.

Moreover, as the fan is arranged in the lower part of the liquid crystal light valves, the polarizing plate of the light valve can be efficiently cooled.

2. Claims

[Claim 1] A liquid crystal projector comprising:

a case; a projection light source having a cooling fan; light separating means for dividing light emitted from the light source into a plurality of colored rays; a plurality of image-forming liquid crystal light valves for forming images by respectively modulating the divided colored rays; light combining means for combining the colored rays modulated by the liquid crystal light valves; and a projection lens for projecting the composite images combined by the light combining means, wherein the projection light source, the light separating means, the plurality of image-forming liquid crystal light valves, the light combining means, and the projection lens are arranged within the case so that a principal light path of one colored ray from the light source to the projection lens is configured so as to have an L-shape in plan view, and wherein the cooling fan of the projection light source is arranged in a space surrounded by the light separating means, the light source, and the front surface and one side surface of the case, and generated by formation of the L-shaped principal light path.

[Claim 2] A liquid crystal projector comprising:

a case; a projection light source; light separating means for dividing light emitted from the light source into a plurality of colored rays; a plurality of image-forming liquid crystal light valves for forming images by respectively modulating the divided colored rays; light combining means for combining the colored rays modulated by the liquid crystal light valves; a projection lens for projecting the

composite images combined by the light combining means; a power supply unit; a cooling fan; and a driving control circuit, wherein the projection light source, the light separating means, the plurality of image-forming liquid crystal light valves, the light combining means, and the projection lens are arranged within the case, and in the vicinity of the light source, the power supply unit and the cooling fan for cooling the light source and the power supply unit are arranged, and wherein the driving control circuit is arranged at a position within the case and separated from the power supply unit.

[Claim 3] A liquid crystal projector according to Claim 1 or 2, further comprising a second cooling fan disposed under the liquid crystal light valves.